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State of California

The Resources Agency

DEPARTMENT OF FISH AND GAME

STANDING STOCKS OF FISHES IN SECTIONS OF INDIAN CREEK, PLUMAS COUNTY, 1981

by

Nick A. Villa

Bay-Delta Fishery Project
Contract Services Section
Information Report
82-1

This report, which has not been reviewed beyond the level of the Contract Services Section Supervisor, Larry Puckett, contains data that would not otherwise be available in a report format. The work was funded by the Department of Water Resources under W.A. 1600.

INTRODUCTION

In 1976, the Department of Water Resources (DWR) initiated an instream flow program to (1) identify streams that would benefit from flow enhancement, (2) assess instream values, and (3) identify trade-offs required to enhance these streams. The Northern District of DWR selected Indian Creek below Antelope Reservoir (Figure 1) as one of the streams to study under this program. Initial flow studies by DWR indicated that flow augmentation would probably double trout habitat in the first 16 km of Indian Creek below the dam and increase habitat by 25 percent in lower reaches (Hinton MS). As a result of this study, DWR with the support of the Department of Fish and Game (DFG) decided to reoperate Antelope Reservoir to increase flow releases from 0.1 cms to 0.6 cms year-round on a trial basis. These flows were also selected to avoid impairing recreation at Antelope Reservoir.

This report summarizes the fourth year of a five-year study to monitor fish populations in selected sections of Indian Creek. In addition to this, the Contract Services Section has been assisting DWR personnel in determining fishing effort and catch in the creek. A separate report has been completed for both aspects of the project for each year of study. Next year an administrative report will be written combining both the fish population monitoring and fishing effort and catch data. That report will summarize five years of study for the evaluation of the effect of increased flows on the fisheries of Indian Creek and will present possible reoperation alternatives for Antelope Reservoir.

METHODS

Standing stocks of fishes were estimated at six stations (each containing riffles and pools) in Indian Creek (Figure 1). For comparative purposes

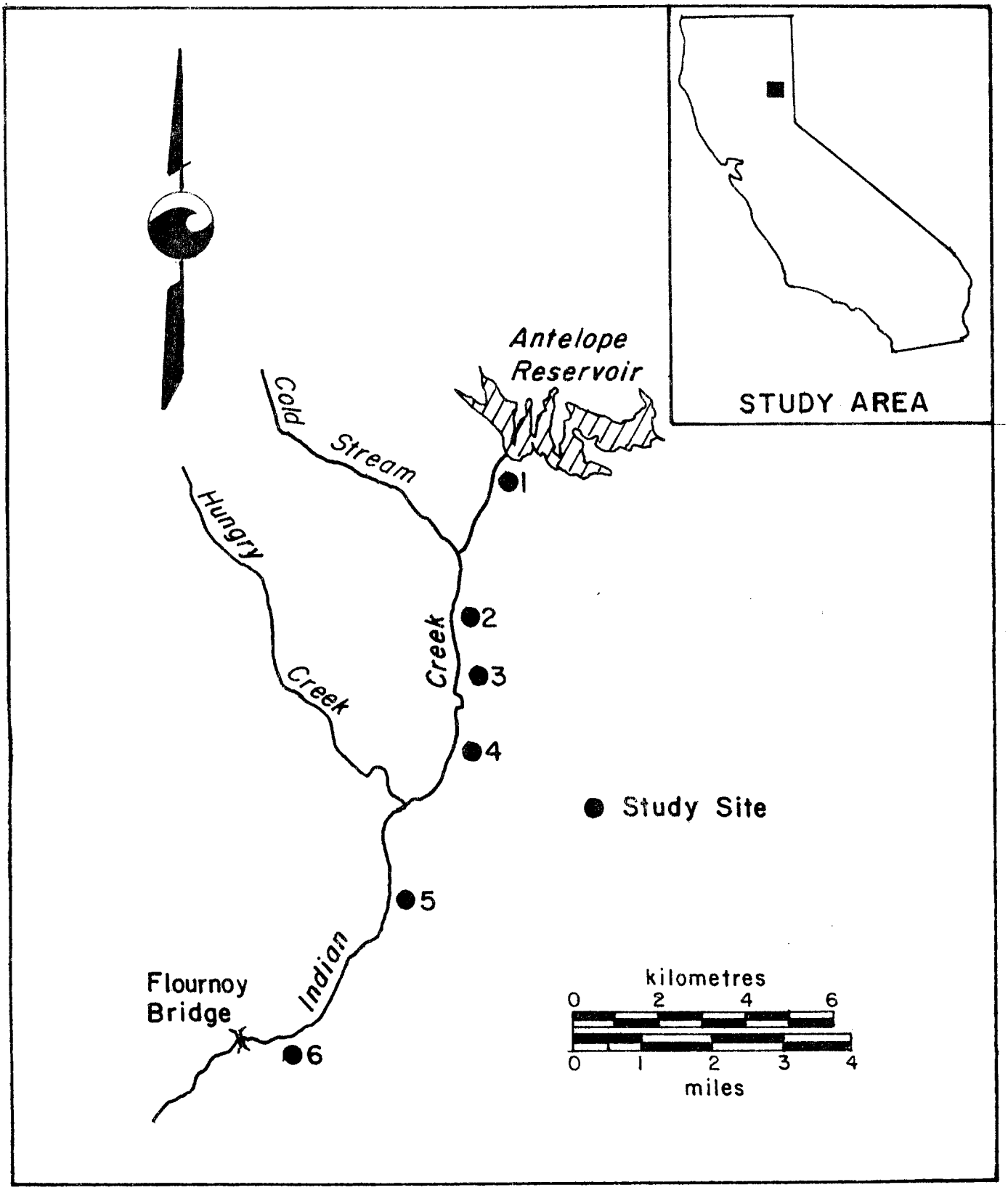

Figure 1 - Stations sampled to determine biomass of fishes in Indian Creek, Plumas County, September 1981

stations were chosen near areas sampled in previous studies by Region 2 of the Department of Fish and Game. Markers were placed in trees along the stream to permanently identify station boundaries for future sampling. Stations varied in length from 34 to 74 m. Station lengths, average widths, and average depths were measured. Fish were captured with battery-powered backpack or portable generator-powered electroshockers in stream sections which were blocked with nets. Fish were removed from the section on each pass. Standing stock estimates were developed using the two-count method of Seber and LeCren (1967).

The weight of each fish was determined to the nearest gram by water displacement in a graduated cylinder. Fork length of each fish was measured to the nearest millimetre.

Fish scales were mounted dry between microscope slides and the scale images were projected through a Bausch and Lomb microprojector at a magnification of 42X. Scale annuli and radii were measured to the nearest millimetre along the anterior radius of the anterior-posterior axis of the scale.

Predictive regressions were used to describe the body-scale and length-weight relationships (Ricker, 1975). Estimation of true mean growth rate (G) was calculated using the methods of Ricker (op. cit.).

RESULTS

Distribution

We caught brown trout (Salmo trutta), rainbow trout (Salmo gairdneri), golden shiner (Notemigonus crysoleucas), Sacramento sucker (Catostomus occidentalis), and brown bullhead (Ictalurus nebulosus). Brown trout were caught at every station. Although we did not catch them at each station, rainbow trout were observed throughout the creek (Table 1).

TABLE 1

DISTRIBUTION OF FISHES IN SECTIONS OF
INDIAN CREEK, PLUMAS COUNTY, 1981

	Station Number					
	1	2	3	4	5	6
Distance below Antelope Dam (km)	0.6	3.9	5.3	6.8	12.3	21.0
Brown Trout	x	x	x	x	x	x
Rainbow Trout	x				x	x
Brown Bullhead			x		x	
Golden Shiner	x					
Sacramento Sucker						x

Standing Crop

Brown trout was the most common game fish caught and biomass averaged 4.51 g/m^2 at six stations (Table 2). Rainbow trout averaged 1.40 g/m^2 in three stations (Table 3). Biomass of brown trout large enough to be kept by most fishermen (127 mm FL) averaged 1.22 g/m^2 and biomass of rainbow trout large enough to be kept averaged 1.26 g/m^2.

Brown bullhead was the most common non-salmonid fish caught. We calculated an average of 0.45 g/m^2 in two stations (Table 4). The biomass of one golden shiner in station 1 was calculated at 0.005 g/m^2 while the biomass of one Sacramento sucker was 0.67 g/m^2 for station 6.

TABLE 2

ESTIMATES OF BROWN TROUT STANDING CROP IN
INDIAN CREEK, PLUMAS COUNTY, 1981

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass g/m^2	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout g/m^2
0.6	38	35-41	2.32	4	0.21
3.9	103	96-110	6.32	25	1.17
5.3	72	64-80	10.16	26	3.24
6.8	48	44-51	2.19	4	0.10
12.3	108	91-125	2.16	20	0.27
21.0	8	8-8	3.92	6	2.31

TABLE 3

ESTIMATES OF RAINBOW TROUT STANDING CROP IN
INDIAN CREEK, PLUMAS COUNTY, 1981

Distance Below Antelope Dam (km)	Population Estimate	95 Percent Confidence Interval	Biomass g/m^2	Estimate of Catchable Trout (≥ 127 mm FL)	Biomass of Catchable Trout g/m^2
0.6	3	3-3	0.87	2	0.27
12.3	7	7-7	0.14	4	0.10
21.0	15	15-15	3.18	13	3.42

TABLE 4

ESTIMATES OF STANDING CROPS OF NONGAME FISHES
IN INDIAN CREEK, PLUMAS COUNTY, 1981

Distance Below Antelope Dam (km)	Species	Population Estimate	95 Percent Confidence Interval	Biomass g/m^2
0.6	Golden Shiner	1	--	0.005
5.3	Brown Bullhead	1	--	0.45
12.3	Brown Bullhead	5	2-7	0.45
21.0	Sacramento Sucker	1	--	0.67

Age and Growth

The formula L = 17.8 + 1.00 S describes the relationship between the fork length (L) and enlarged scale radius (S) of 148 brown trout. The coefficient of corelation (r) was 0.92. The formula was L = 17.7 + 1.03 S for 33 rainbow trout. The value for r was also 0.92.

We caught no brown trout older than 4+ years. Fish of this age averaged 366 mm in length, while 3+ fish averaged 293 mm, 2+ fish averaged 176 mm, and 1+ fish averaged 94 mm (Table 5).

Growth as measured for the population and for the mean individual growth rates was faster for age 1+ brown trout than for age 2+ fish (Table 6). We captured too few fish to compute growth for rainbow trout.

TABLE 5

CALCULATED FORK LENGTH IN MILLIMETRES
OF BROWN TROUT FROM INDIAN CREEK,
PLUMAS COUNTY, TAKEN IN SEPTEMBER 1981

Age	Number of Fish	Length at Capture (mm)	Calculated Lengths at Successive Annuli (mm)			
			1	2	3	4
1	37	96	94			
2	87	158	102	176		
3	8	211	121	213	293	
4	1	452	143	242	324	366
Number of back-calculations			133	104	9	1
Weighted means			101	180	296	366
Increments			101	79	116	70

TABLE 6

GROWTH RATES FOR BROWN TROUT
CAUGHT IN INDIAN CREEK, 1981

Age Interval	Population Growth			Mean Individual Growth		
	Length Interval mm	Difference of Natural Logarithms	Instantaneous Growth Rate Gx	Length Interval mm	Difference of Natural Logarithms	Instantaneous Growth Rate G
1-2	94-176	0.627	1.847	102-176	0.546	1.611
2-3	176-293	0.510	1.503	213-293	0.319	.938
3-4	293-366	0.223	.656	324-366	0.122	.279

Length and Weight

Age group 0+ brown trout represented 60 percent of the catch, while 1+ fish made up 25 percent, 2+ fish comprised 12 percent and 3+ fish represented 3 percent (Figure 2). In contrast, age 0+ rainbow trout comprised 17 percent of the catch while age 1+ comprised 54 percent and age 2+ comprised 29 percent (Figure 3).

The relationship between length (L) and weight (W) of brown trout is:

$$\text{Log}_{10}W = 4.8703 + 2.948\ \text{Log}_{10}L$$

$$r = 0.99$$

$$N = 282 \text{ (Figure 4)}$$

The same relationship for rainbow trout is:

$$\text{Log}_{10}W = 4.9421 + 2.9877\ \text{Log}_{10}L$$

$$r = 0.99$$

$$N = 33 \text{ (Figure 5)}$$

Coefficient of Condition

We calculated the coefficient of condition and 95 percent confidence limits for 139 brown trout and 33 rainbow trout (Table 7). There is no significant difference between the coefficient of condition for any age group of brown trout or rainbow trout we tested ("t" test, 0.05 level).

Acknowledgements

Aides Steve Lund, Vance McGowan, and Ann Schenk assisted in all phases of field work and data reduction. Charles Brown reviewed the manuscript.

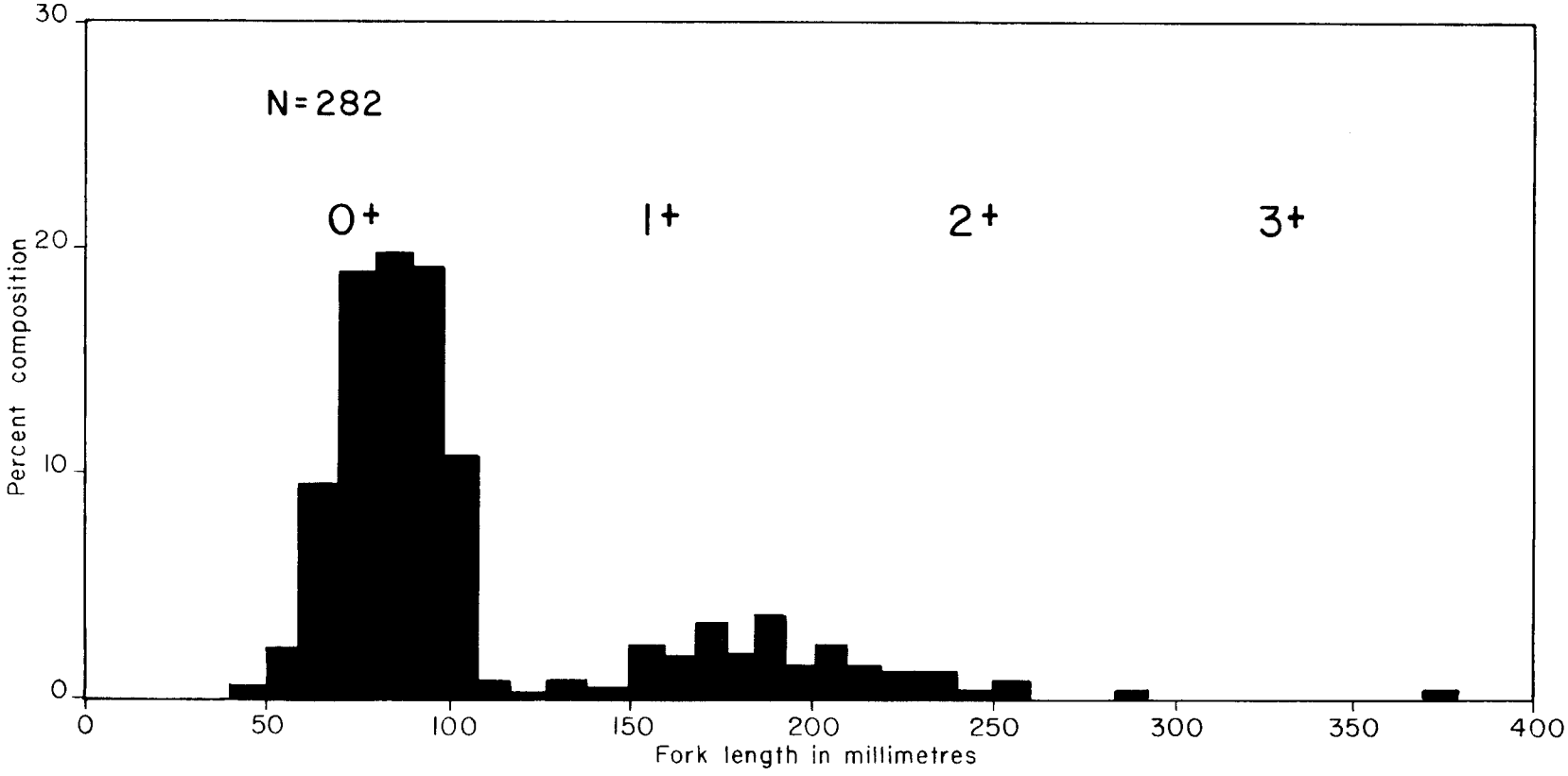

Figure 2- Length, frequency of occurence, and age of brown trout caught in sections of Indian Creek, Plumas County, 1981

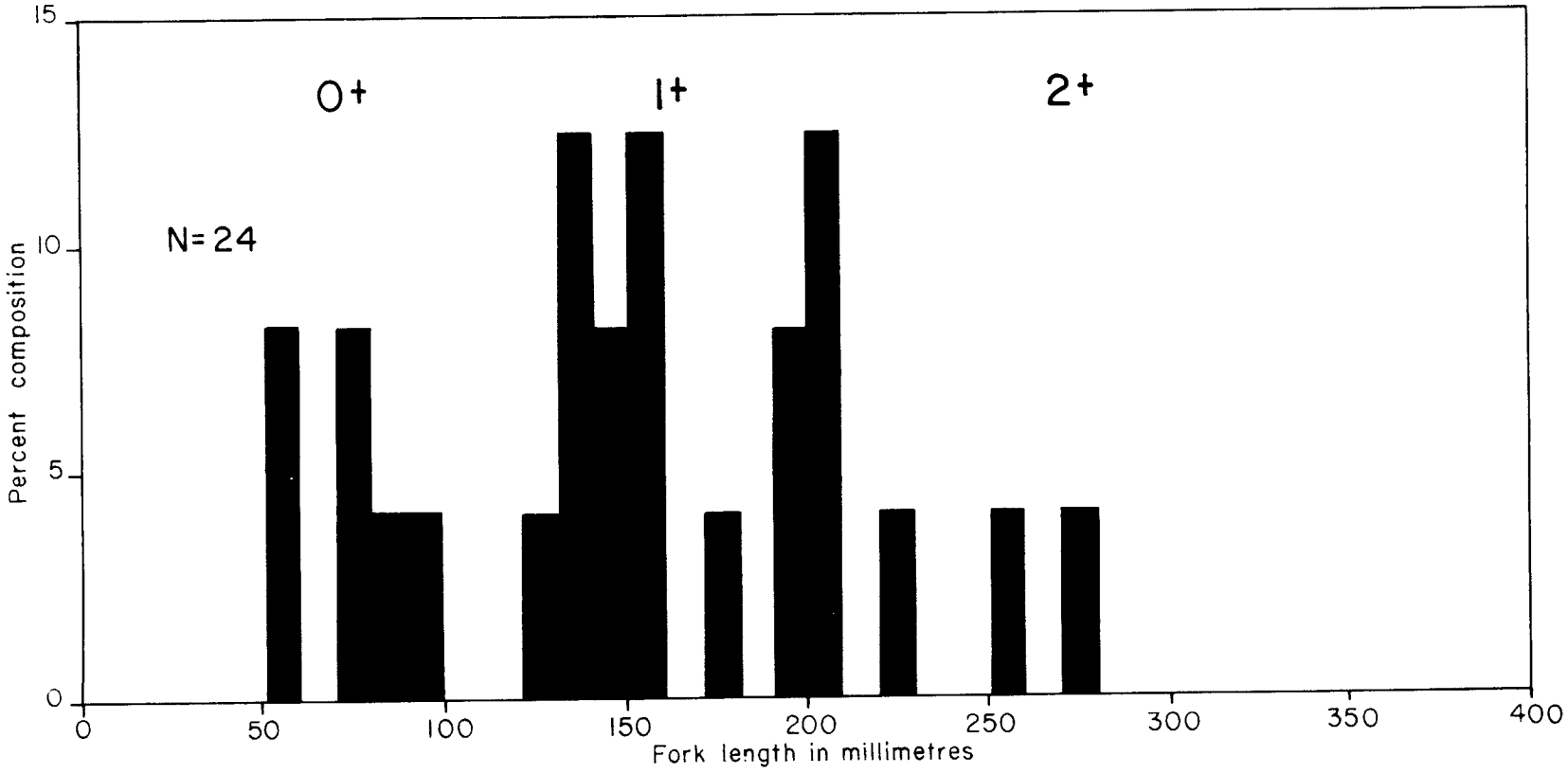

Figure 3- Length, frequency of occurence, and age of rainbow trout caught in sections of Indian Creek, Plumas County, 1981

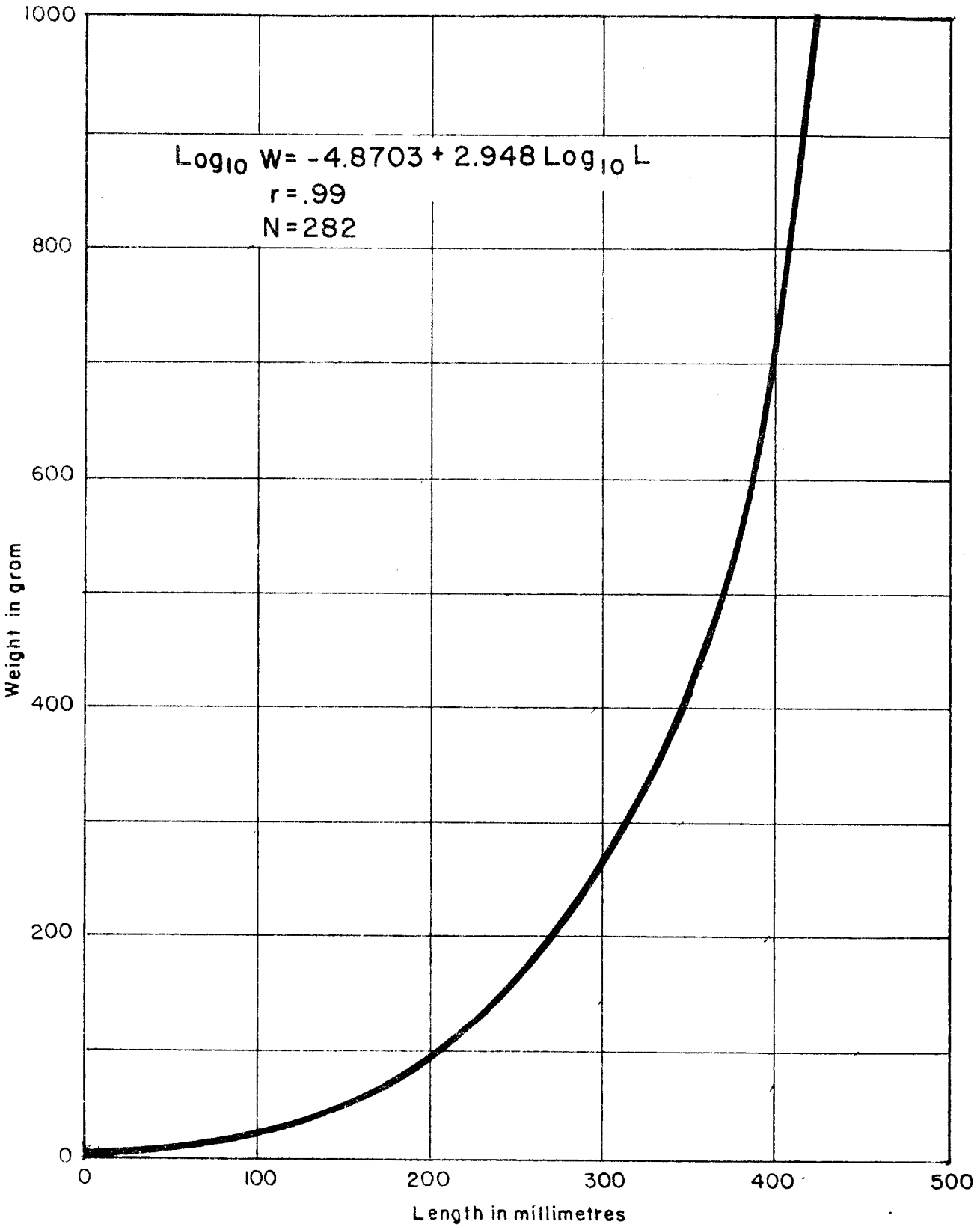

Figure 4 - The relationship between length and weight of brown trout caught in sections of Indian Creek, Plumas County, 1981.

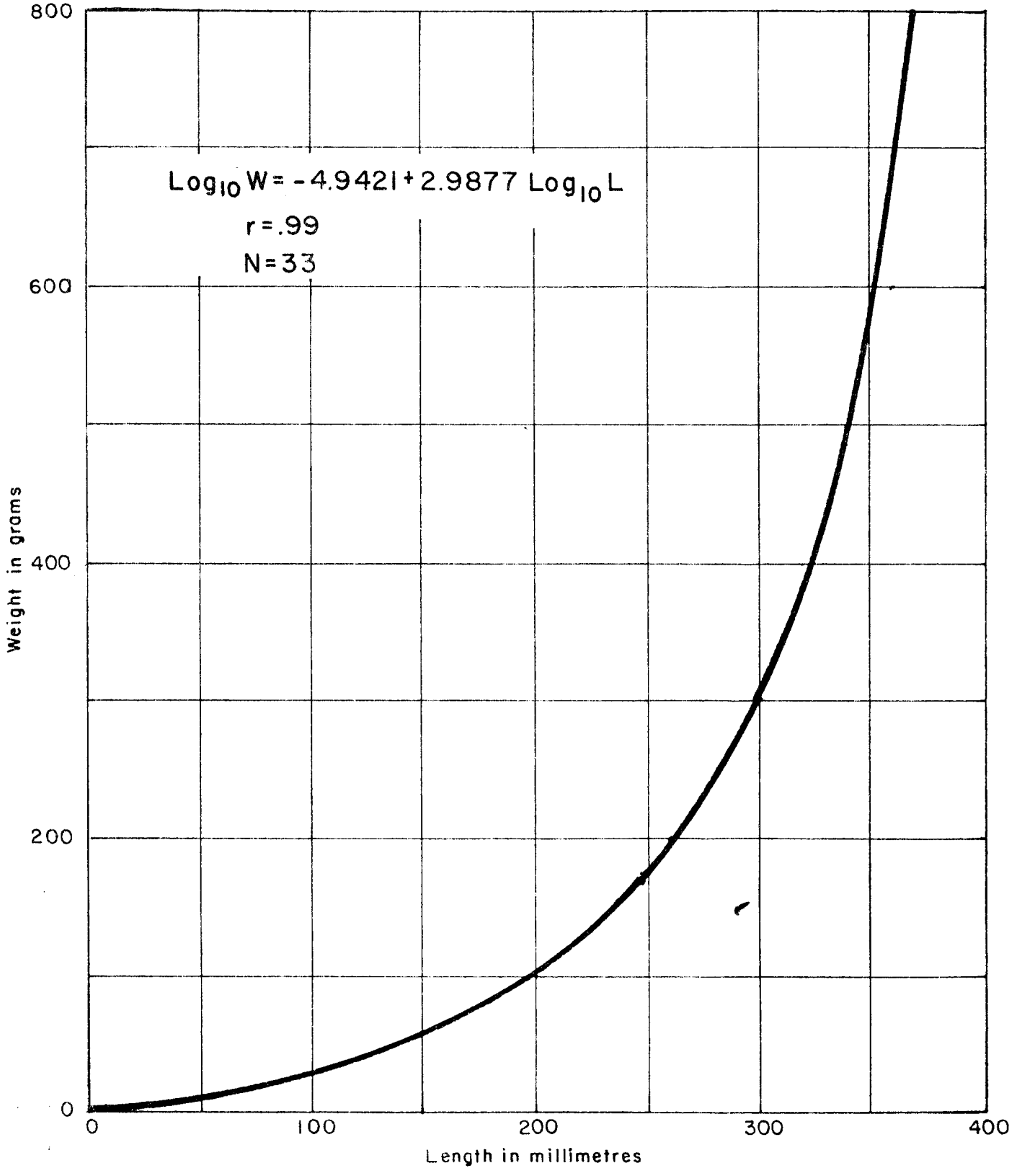

Figure 5 – The relationship between length and weight of rainbow trout caught in sections of Indian Creek, Plumas County, 1981

TABLE 7

CONDITION OF BROWN TROUT AND RAINBOW TROUT
IN INDIAN CREEK, 1981

Age Group	Number of Fish	Coefficient of Condition	95% Confidence Interval
Brown Trout			
0+	14	1.105	+ .056
1+	33	1.045	+ .029
2+	85	1.046	+ .087
3+	6	0.94	+ .123
4+	1	1.191	--
Combined	139	1.048	+ .016
Rainbow Trout			
0+	5	1.158	+ .926
1+	18	1.004	+ .464
2+	10	1.004	+ .622
Combined	33	1.032	+ .352

LITERATURE CITED

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Seber, G. A. F., and E. D. LeCren. 1967. Estimating population parameters from catches large relative to the population. J. Animal Ecology. 36(3): 631-643.

APPENDIX 1

PERMANENT FISH POPULATION STATIONS
INDIAN CREEK, PLUMAS COUNTY
SEPTEMBER 1981

APPENDIX I

PERMANENT FISH POPULATION STATIONS
INDIAN CREEK, PLUMAS COUNTY
SEPTEMBER 1981

Station 1 - Located 0.6 km below Antelope Dam adjacent to picnic area near junction of Indian Creek Road and spur road leading to base of dam (NE¼ of NE¼, Section 27, T27N, R12E). The station extends 48 m upstream and 24 m down stream from a 13-cm-diameter pine (LB). The station consists of a riffle (40%) and a long pool (60%). This station has been modified from previous years by a beaver dam constructed downstream which has turned the wrong portion of the station (formerly riffle) into a deep pool. The station has a surface area of 764 m and a volume of 291 at 0.6 cms.

Station 2 - Located 13.8 km above Flournoy Bridge, 1.9 km below Cold Stream, and about 3 9 km below Antelope Dam (SW¼ of SW¼, Section 34, T27N, R12E). The station extends 35 m from a 36-cm-diameter alder (RB) downstream to a 10-cm-diameter pine (RB). Both are marked with metal disks which can be seen from the road. The station contains riffle (65%) and shallow pool (355) areas. It has a surface area of 310 m^2 and a volume of 101 m^3 at 0.6 cms.

Station 3 - Located 11.5 km above Flournoy Bridge, 3.7 km above Hungry Creek, and about 5.3 km below Antelope Dam (NW¼ of NW¼, Section 10, T26N, R12E). The lower end of the station is about 29 m upstream from the upper end of a parking turnout. The station extends 40 m upstream from a 38-cm-diameter alder (RB) to a 28-cm diameter pine (RB). Both are marked with metal disks which can be seen from the creek. The section contains a riffle area which enters a 0.9 m-deep pool followed by a riffle and a shallow pool. (Riffle area totals 40%, pool area 60%). It has a surface area of 284 m^2 and a volume of 106 m^3 at 0.6 cms.

Station 4 - Located 10.9 km above Flournoy Bridge and about 6.8 km below Antelope Dam (NW¼ of SW¼, Section 10, T26N, R12E). Upper end of station is just downstream from a drainage ditch at the lower end of a parking turnout located 0.3 km above Babcock crossing. Station extends 40 m downstream to the end of a riffle just above a long, shallow pool. It contains riffle (55%) and shallow pool (45%) areas with a small amount of undercut bank (RB). It is not marked with metal disks. The station has a surface area of 328 m^2 and a volume of 65 m^3 at 0.6 cms.

Station 5 - Located at unimproved campground about 5.5 km upstream from Flournoy Bridge and about 12.3 km below Antelope Dam (SW¼ of SW¼, Section 21, T26N, R12E). The station extends 70 m upstream from the lower end of a riffle area with several grassy hummocks (Transect 3 of the fish habitat evaluation study). Metal disks on a small willow at the lower end (LB) and a large alder snag at the upper end (RB) mark the station. The station contains a riffle and shallow run area, a shallow pool with undercut bank (RB), and a riffle area. (Riffle area is 60%, pool area 40%). It has a surface area of 685 m^2 and a volume of 169 m^3 at 0.6 cms.

Station 6 - Located about 0.9 km upstream from Flournoy Bridge and about 21 km below Antelope Dam. Drive 0.3 km east of Flournoy Bridge and take paved spur road to right. Drive 0.6 km to gate in fence on right side of road. Follow trail from gate downstream 85 m along creek where alders on RB end and a steep riffle enters a pool. The lower end of the station is at the top of the steep riffle. The station extends 40 m upstream and is marked with metal disks on 10-cm-diameter alders (RB). The disks are hard to find because there are lots of alders along the right bank. The upper half of the station is a riffle and shallow pool, followed by a rocky run and a small pool in the lower half. (Riffle area totals 45%, pool area 55%). The station has a surface area of 372 m^2 and a volume of 107 m^3 at 0.6 cms.

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1981

APPENDIX 2

LENGTH AND WEIGHT OF BROWN TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER, 1981

Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
52	1.4	84	6,6.3,6.5,6.6,6.9,7	163	50
53	1.6	85	6.3,6.5,6.7,7.5	164	48,54
54	2	86	6.6,6.6,6.6,6.8,7,7,7.1	166	46
55	1.7,1.8	87	3.6,6,7,7.9	170	48
58	2.2	88	6.7,7,7.4,8,8,8.5,8.5	171	59
59	1.8,2	89	7.3,7.5,7.6,8.5	172	49,50,53
60	2,2.1,2.5,2.8	90	6.2,6.7,7,7.5,7.5,7.7,	173	49,57
61	2.8,3		8,8,8.5,9	175	51
62	1.4,2.2	91	6.6,7.5,8.3,8.5,9,9,9,	176	53,54,55
63	2.7,2.8,3		9.5,9.6	177	56
64	2.6,2.6	92	6.2,7.6,8,8.1,8.1,8.5,	180	56
65	2.8,2.9,3		8.5,8.8,9,9,9,11	181	61
66	2.8,3.4,3.8	93	9,9,9.2,9.2,9.3,10	182	63,67
67	2.8,3,3.4	94	8.4,8.5,9.5,10,10,10	183	63
68	3.1,3.2,3.4,3.5	95	8.5,9	184	60,60,63
69	3.4,3.6,3.6,3.6,	96	9	185	80
	3.6,3.6,3.6	97	9,9,9.5,10.5,11,11	186	69,70
70	3.4,3.6,3.7,3.8,	98	7,9.3,9.5,9,7,9.8,10,	187	70
	4,4,4.2		10,10,10,10.5,11	189	71
71	4.1,4.5	99	9.6,10,10.5,11	193	68,79
72	3.8,3.8,3.8,4,	100	9.5,10.5,10.6,10.7,13.5	197	81
	4.1,4.3,4.5,4.8,5	101	11,11,11,12.5	198	77,86
73	3.3,4,4.5,4.8,4.8	102	10,12.5	200	82,97
74	4,4.2,4.5,5,5.5	103	12,12.5,13,13	202	79,80,83
75	3.6,4.2,4.3,4.5,	104	11,12,12.5	204	86,90
	4.7,4.7,4.8,5	105	13.5,14	209	87
76	4.4,4.7,4.8,4.8,	106	13	211	100
	4.9,5.1,5.4	107	14,15	213	100
77	4.5,4.5,4.7,4.7,4.8,	109	15	214	100
	4.9,5,5.4	111	14	216	103,115
78	4,4.9,5,5.2,5.8,5.8,	117	17	217	92
	5.9,6,6	123	21	220	107
79	5.5,5.5,5.6,5.8,6.6,	132	22	223	110
	7.9	137	24	224	128
80	4.5,4.8,5,5.3,5.6,5.7,	139	28	226	114
	5.9,6.2,6.4	142	28	229	130
81	5.3,5.6,5.7,5.7,5.7,	151	38	232	127,130
	6,6.2,6.3,6.4,6.6	152	42	234	122
82	5.5,5.5,5.6,6.4,6.5,	154	32,38,80	237	127,142
	6.5,7.5	157	37,42,43,57	247	152
83	5.2,5.5,5.7,6,6,6.1,	160	42	255	200
	6.1,6.3,6.3,6.5	161	36	257	190
		162	39	283	255
				366	510

APPENDIX 3

LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER 1981

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LENGTH AND WEIGHT OF RAINBOW TROUT
CAUGHT IN INDIAN CREEK, SEPTEMBER, 1981

Length (mm)	Weight (g)
54	1.8
57	2.0
73	4.4,5
83	6
91	9.5
129	22
130	20
134	24
135	20
140	28
148	32
151	36
156	36
159	38
175	58
190	70
199	80
200	76
201	78,80
223	112
254	180
272	190

APPENDIX 4

METRIC CONVERSION FACTORS

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METRIC CONVERSION FACTORS

Quantity	Metric Units	Divide by	English Units
Length	millimetres (mm)	25.4	inches (in)
	centimetres (cm)	2.54	inches (in)
	metres (m)	0.3048	feet (ft)
	kilometres (km)	1.6093	miles (mi)
Area	square metres (m^2)	0.0929	square feet (ft^2)
Volume	cubic metres (m^3)	0.7646	cubic yards (yd^3)
Flow	cubic metres per second (cms)	0.0283	cubic feet per second (cfs)
Biomass	grams per square metre (g/m^2)	8.92	pounds per acre (lb/acre)